

THE ENVIRONMENTAL SCIENCE AND TECHNOLOGY DIVISION
OFFICE OF SCIENCE AND TECHNOLOGY
National Energy Technology Laboratory, Department of Energy

MISSION: The mission of the Division is to conceive, plan, manage and conduct exploratory and applied research in the areas of environmental science and technology. In addition, the Division develops and maintains core competencies and provides technical expertise to matrix teams managing NETL environmental research programs. The Division also serves as a place to initiate novel environmental research projects of importance to NETL, and provides technical assistance to other government agencies and DOE programs.

PERSONNEL/FACILITIES: The Environmental Science and Technology Division consists of 26 interdisciplinary employees: 13 scientists (biologists, chemists and geologists), 8 engineers (chemical, mechanical and mining) and 5 engineering and physical science technicians. Areas of expertise include flue gas cleanup technology, coal combustion residue utilization, mine drainage prediction, control and remediation, and wastewater treatment. Research efforts have produced new technologies that are being used by industry and state reclamation agencies, as well as by other federal agencies, to effectively combat their air, water and solid waste problems.

Key facilities include: a 500-lb/hr (0.75-MW) coal combustor that has been used to investigate dry, regenerable sorbent processes, spray drying techniques, fundamental duct injection technologies, and, most recently, air toxics; a closed loop, life-cycle test system capable of a continuous mode of integrated operation with absorption/regeneration steps, which is currently being used to study the Moving-Bed Copper Oxide Process; thermogravimetric and microbalance reactors; a packed-bed reactor, which is being used to evaluate the NO_x removal function of regenerable sorbents/catalysts; microbiological laboratories and bench-scale bioreactors; a pilot-scale water treatment facility, currently being utilized to evaluate the use of biologically-generated sulfate reduction technology; established laboratory-scale leaching operations, with associated analytical support; various electromagnetic and geophysical technical capabilities; and access to an on-site underground research coal mine.

OPERATIONAL STRUCTURE: The Division has four research teams that collaborate and cooperate to solve environmental problems related to energy extraction, processing and utilization.

The **Clean Water Team** is currently conducting basic and applied research related to the prediction, prevention, and treatment of water contaminated by the mining and processing of coal and metals. The team also conducts research on the development of inexpensive water treatment technologies at inactive and abandoned sites that are currently the problems of local, State and Federal agencies.

The **Solid Waste Team** develops solutions to environmental problems related to wastes generated formed during the mining, processing and utilization of coal. These materials include: fly ash and

other by-products of coal combustion, tailings, mine spoil, coal cleaning residues, and contaminated soil. Aspects of the subsurface movement of fluids (groundwater or contaminant plumes) through disturbed geologic strata is also addressed by this team.

The **Innovative Technologies Team** is responsible for developing and demonstrating new environmental technologies that will supplant current engineering practices. The team identifies environmental needs by reaching out to businesses, governments, and academia; uses laboratory, modeling, and other resources within NETL and its partners to explore selected concepts; and conducts proof-of-concept experiments and field demonstrations.

INTERNAL NETL FACTSHEET

for

Water Pollution Team

Team Leader: Terry Ackman

MISSION STATEMENT:

The water pollution team conducts basic and applied research related to the avoidance and remediation of surface and sub-surface water contamination problems that are engendered or affected by the extraction, processing, production or utilization of energy. Five projects are currently underway. One project involves the pilot-scale development and field testing of a system using bacterial sulfate reduction to treat waste streams containing high concentrations of sulfate and heavy metals. A key aspect of this work is that metals can be economically recovered from a wastewater solution, rendering the final waste product non-hazardous, and greatly offsetting the costs of treatment. A second project is attempting to improve premine predictions of post-reclamation water quality. Prevention of acid generation can be accomplished if accurate predictions can be made. A third project is analyzing the role of bacterial catalysis in acid mine drainage formation in underground mines and is seeking effective ways of inhibiting that catalysis. A fourth project is examining the use of waste combustion gases to reduce the volume and improve the settling characteristics of metal hydroxide sludges generated during conventional water treatment. The final project, in collaboration with the state of PA, the U.S. EPA, and a local watershed association, involves the testing and demonstration of technologies designed to treat underground coal mine drainage contaminating the Sewickley Creek watershed in Westmoreland Co., PA.

FACILITIES

Microbiology

- Complete microbiology laboratory including capability for DNA amplification and sequencing,
- Isotope laboratory including gamma and scintillation counters, and a mossbauer spectrometer for the analysis of Fe-compounds,
- Phase-contrast binocular microscope with epifluorescence attachment,
- Bioreactor for the hyperbaric culturing of aerobic bacteria,
- 2 L automated fermenters.

Analytical Chemistry

- Water analysis laboratory with EPA CLP protocol capability,
- Laboratory for the analysis of atmospheric gases, hydrocarbons through C₅, SF₆, H₂S, and low-level H₂,
- Electrochemical analysis system for corrosion voltammetry,
- GC-MS and HPLC for the identification and analysis of organic pollutants.

Pilot-Scale Treatment

- 42.5 L upflow anaerobic sludge blanket bioreactor,
- 50 L gas-lift loop anaerobic bioreactor,
- 8 L fixed-film aerobic bioreactor,
- 1 L/min cross-flow ultrafiltration system with ceramic membrane.

INTERNAL NETL FACTSHEET

for

Solid Waste Team

Team Leader: Ann Kim

MISSION STATEMENT

The Solid Waste Team develops solutions to environmental problems related to wastes generated during the mining, processing and utilization of coal. These materials include fly ash and other by-products of coal combustion, tailings, mine spoil, coal cleaning residues, and contaminated soil. Aspects of the subsurface movement of fluids (groundwater or contaminant plumes) through disturbed geologic strata are also addressed by this team, as are requests for technical advice and assistance by OSMRE and state agencies with respect to AML fires.

FACILITIES

This team has available a wide variety of equipment for laboratory and field studies of environmental problems, including:

<u>Item</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Purpose</u>
Gas Chromatograph	Hewlett Packard	550A	Analysis of gas samples from underground AML fires
Gas Chromatograph	MTI	P-200	On-site analysis of gas samples
Automatic Titrator	Mettler	DL25	Acidity/alkalinity titrations
Terrain Conductivity Meter	Geonics LTD	EM31-D	Location of subsurface conductive zones

Proton Precession Magnetometer	EG&G Geometrics	G-856	Location of subsurface magnetic anomalies
Leaching Columns	NA	NA	Leaching of 28 1-kg samples at nominal rate of 250 mL/day
GIS system	Magellan	Promark X	Location of field sampling points